Bureau of Mines
Report of Investigations 4598

INVESTIGATION OF THE ORONOGO-WEBB CITY-DUENWEG ZINC-LEAD DISTRICT, JASPER COUNTY, MO.

BY OTTO RUHL

United States Department of the Interior — January 1950

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UNITED STATES DEPARTMENT OF THE INTERIOR
Oscar L. Chapman, Secretary
BUREAU OF MINES
James Boyd, Director

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by

Otto Ruhl 1/

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1/ Mining engineer, Bureau of Mines.

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SUMMARY AND INTRODUCTION

The Oronogo-Webb City-Duenweg district is in the northeastern part of the Tri-State zinc and lead field. Its metal-mining history dates from the early 1850's. For some years prior to 1918 it ranked as the leading producing area of the entire Tri-State field, but by 1920 most of its mines had been abandoned and allowed to fill with water. Its mine operators had been attracted to the newly discovered and richer deposits around Picher, Okla.

In 1943, the Oronogo Mutual Mining Co. was exploiting the Oronogo Circle deposit in the northern end of the district, and the Federal Mining & Smelting Co. was preparing to mine on its holdings in the southern part near Duenweg. The area between these two operating units ranked as the largest single block of ore reserves under water in the Tri-State field.

In 1942, engineers of the Bureau of Mines, in collaboration with the William Stewart Engineering Co. of Joplin, collected all available mine maps, mine reports, and logs of old drill holes in the inundated area. From a careful study and appraisal of these data, the reserves in the block were calculated at 20,647,800 tons of ore containing 606,440 tons of 60-percent zinc concentrates and 46,970 tons of 80-percent lead concentrates. The ore was estimated to contain 1.76 percent recoverable zinc and 0.18 percent recoverable lead.2/

With the objective of making these metals available for war uses, the Bureau of Mines proposed a development program. In 1943 the War Production Board requested that a portion of the area be drilled and directed the Metals Reserve Corporation to advance funds to Brown & Root, Inc., for a drilling project to be carried out under the supervision of the Bureau of Mines.

The project drilling began on June 7, 1943, and ended on January 12, 1944. Two hundred and ten churn-drill holes, representing 45,047 feet of drilling, were completed. The descriptive logs of the holes are included in this report.

ACKNOWLEDGMENTS

Acknowledgment is made for the advice and aid of the many local mine operators and mining engineers who cooperated in the preparation of the project. Among these are D'Arcy M. Cashin, general manager of Brown & Root, Inc.; Guy H. Waring, general manager of the Oronogo Mutual Mining Co.; Victor Rakowsky, consulting engineer, and William M. Stewart, of Stewart Engineering Co.; Howard I. Young, president, American Zinc Lead & Smelting Co.; and L. G. Johnson, superintendent of the Federal Mining & Smelting Co. Much advice was obtained from the late Dr. H. A. Buehler, then director of the Missouri Geological Survey. Special acknowledgment is made for the contributions of E. D. Gardner, then regional engineer, and to W. D. McMillan, then district engineer of the Bureau of Mines.

2/ Ruhl, Otto; Allen, S. A.; Holt, S. P.; Ore Reserves of the Tri-State District, Missouri-Kansas-Oklahoma: R. I. 4490, 1949.

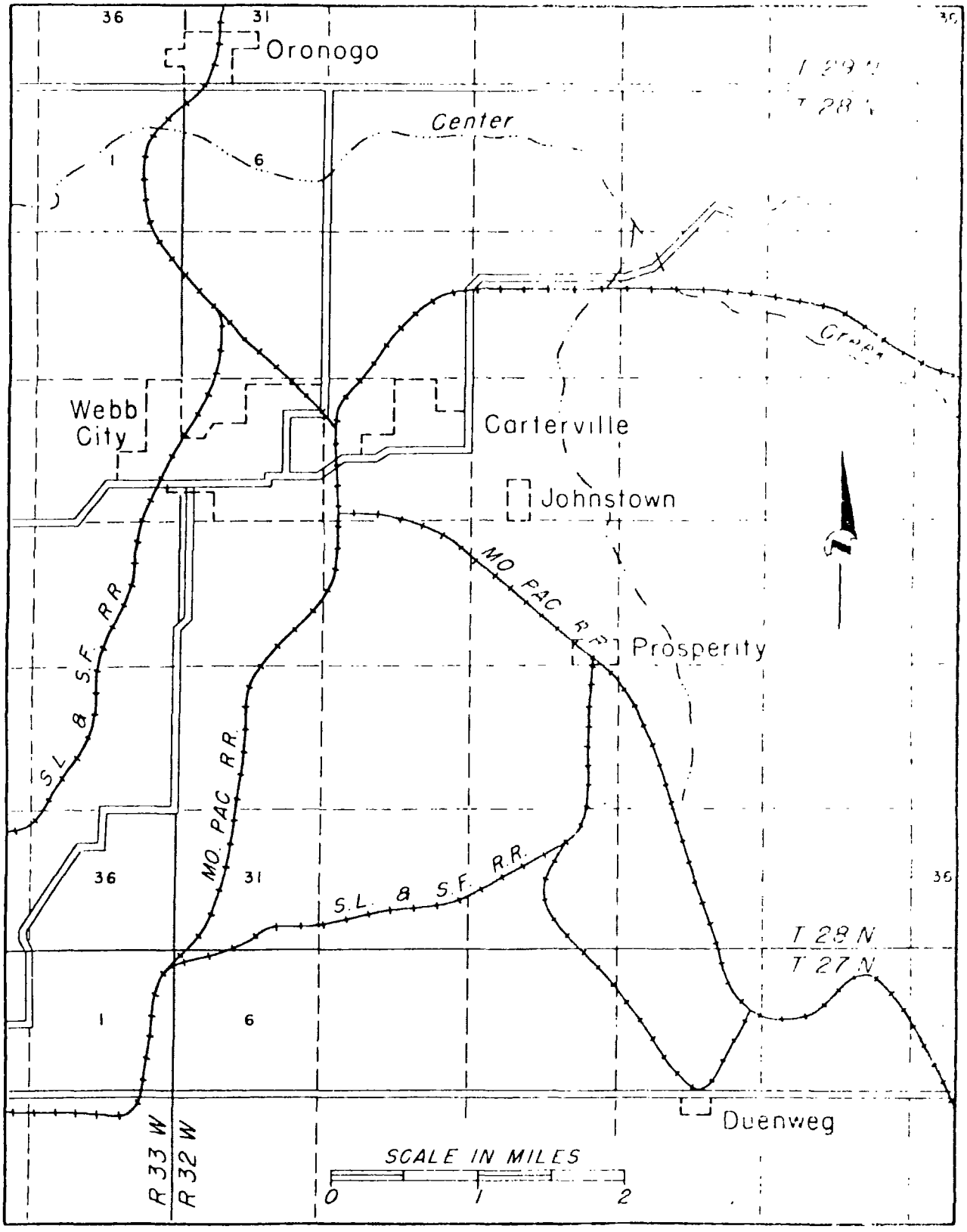

Figure 1. - General location map.

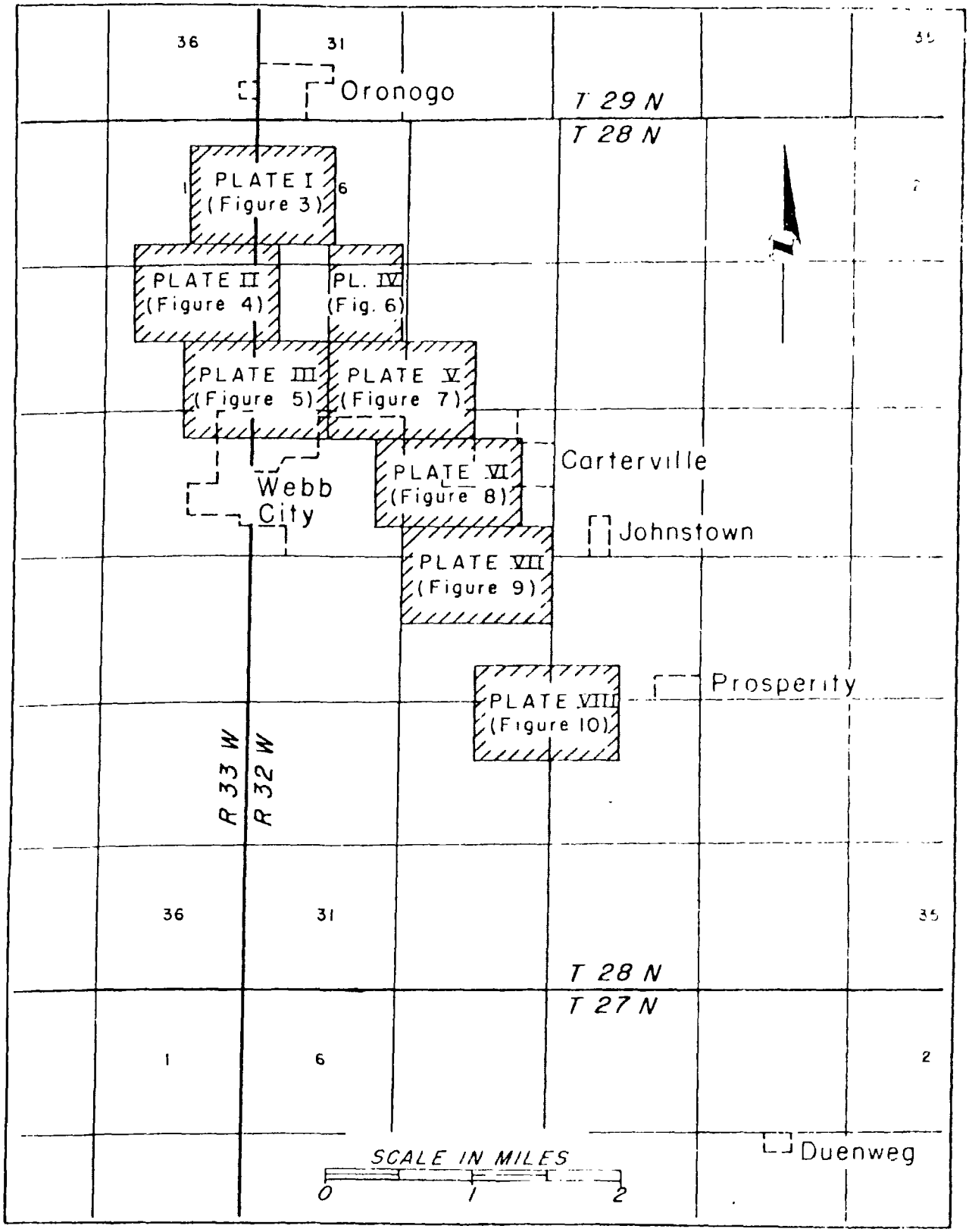

Figure 2. - Map showing location of plates I to VIII.

LOCATION AND PHYSICAL FEATURES

The Oronogo-Webb City-Duenweg Mining district covers an area approximately 8 miles long and 2 miles wide extending in a southeasterly direction from Oronogo to Duenweg in the southern part of Jasper County, Mo. (fig. 1). The center of the district is about 6 miles northeast of Joplin.

Within the limits of the area, approximately 7,000 acres are potentially productive of ore.

Topographically, the country is gently rolling, the maximum relief being about 150 feet. The mean elevation above sea level is 975 feet. Most of the drains northerly toward Center Creek, in the northern part of the area. Center Creek flows west to join Spring River at about 7 miles west of Webb City.

Several paved highways cut across the district, as do also the lines of the Missouri Pacific and the St. Louis & San Francisco Railways.

HISTORY

Lead and zinc ores have been mined in the district for over 90 years, the greater part of the production resulting from operations in effect prior to 1918. By 1920 most of the Webb City area had been abandoned. There has been little activity since 1932.

As of 1932, recorded production reached a total of 1,477,000 tons of zinc and 488,000 tons of lead derived from an estimated 84,000,000 tons of mine ore, representing a recoverable combined metal content of 2.33 percent. For a number of years prior to 1918 the area was responsible for most of the Tri-State zinc and lead production.

At the time of the Bureau's project in 1943 the only active mine operators in the district were the Oronogo Mutual Mining Co., exploiting the Oronogo Circle deposit at Oronogo, and the Federal Mining & Smelting Co., which was building a mill to treat ores from its property near Duenweg. Excepting those affected by pumping operations of the Oronogo Mutual Mining Co., the old mine workings and the ore deposits of the district were under water.

Early in 1943, Brown & Root, Inc., of Houston, Tex., obtained leases on most of the district, extending from a point immediately south of the Oronogo Mutual Mining Co. property to the northern boundary of the Federal Mining & Smelting Co. property at Duenweg (fig. 2).

ORE DEPOSITS

The ore deposits of the Tri-State district are found principally in the Boone formation, lower Mississippian age, which has a thickness of 200 to 400 feet. An occasional ore body occurs in the overlying Chester formation.

The Boone formation was originally a limestone but is now made up of flat-lying beds of limestone, dolomite and chert, nodule beds, and one or

more colite beds. Fowler and Lyden[3/] have correlated 16 distinct beds in the formation ranging in thickness from 4 to 55 feet. The principal ore production has been derived from six of these beds, of which the most important is the "M" bed, the base of which is at an average of 142 feet above the bottom of the Boone. The "M" bed rests upon the Grand Falls chert, in which occur the "sheet ground" deposits, the horizon of most of the reserve ore of the Oronogo-Webb City-Duenweg district.

Three types of ore deposits are found in the Oronogo-Webb City-Duenweg area:

1. Circle deposits, or irregular "runs," occurring at or just below the unconformity between the Pennsylvanian and Mississippian rocks, in sink holes, or along solution channels in the limestones. These deposits are the richer ones of the field and are found from the surface to a depth of 180 feet. They were mined in the early history of the district and, unless entirely new zones of mineralization are discovered, can be considered almost worked out. The Oronogo Circle and Center Creek groups typify this class of deposit.

2. Sheet ground deposits underlying the circle deposits in flat-lying or slightly rolling beds of chert form the type principally considered in this report. The minerals sphalerite and galena occur as "sheets" interbedded with chert, somewhat broken or brecciated, some of the minerals occurring in the interstices of the chert. Intensive development of the "sheet ground" has produced extensive reserves throughout the district.

3. The third type of deposit is found below the "sheet ground" in the Reed's Spring formation and consists of simple and compound "runs" between fairly well-defined fracture walls. Deposits of this type have been mined in the north end of the district and offer the possibility of important extensions through exploration in fractured zones of the Reed's Spring formation. Records indicate that the "runs" contain richer but less extensive ore than the sheet-ground deposits.

The Ore

Sphalerite and galena are the commercial minerals, associated with small amounts of marcasite and larger amounts of jasperoid, calcite, and dolomite. In general, the ore material is readily amenable to concentration by gravity and flotation methods, with a combined extraction in modern mills of 85 percent in zinc and lead concentrates containing 60-percent zinc and 80-percent lead, respectively.

MINE DEVELOPMENT

In this district there have been 146 mining companies operating on the sheet-ground ore horizon. The mine workings resulting from this activity cover 1,307 acres, which is 17 percent of the total possible mineralized zone in the district. The working faces in the mined area have a total length of 38.4 miles (figs. 3 to 11).

3/ Fowler, George N., and Lyden, J. P., The Ore Deposits of the Tri-State District (Missouri, Kansas, and Oklahoma): A.I.M.E. Tech. Paper 446-1, vol. 39, Jan. 1932.

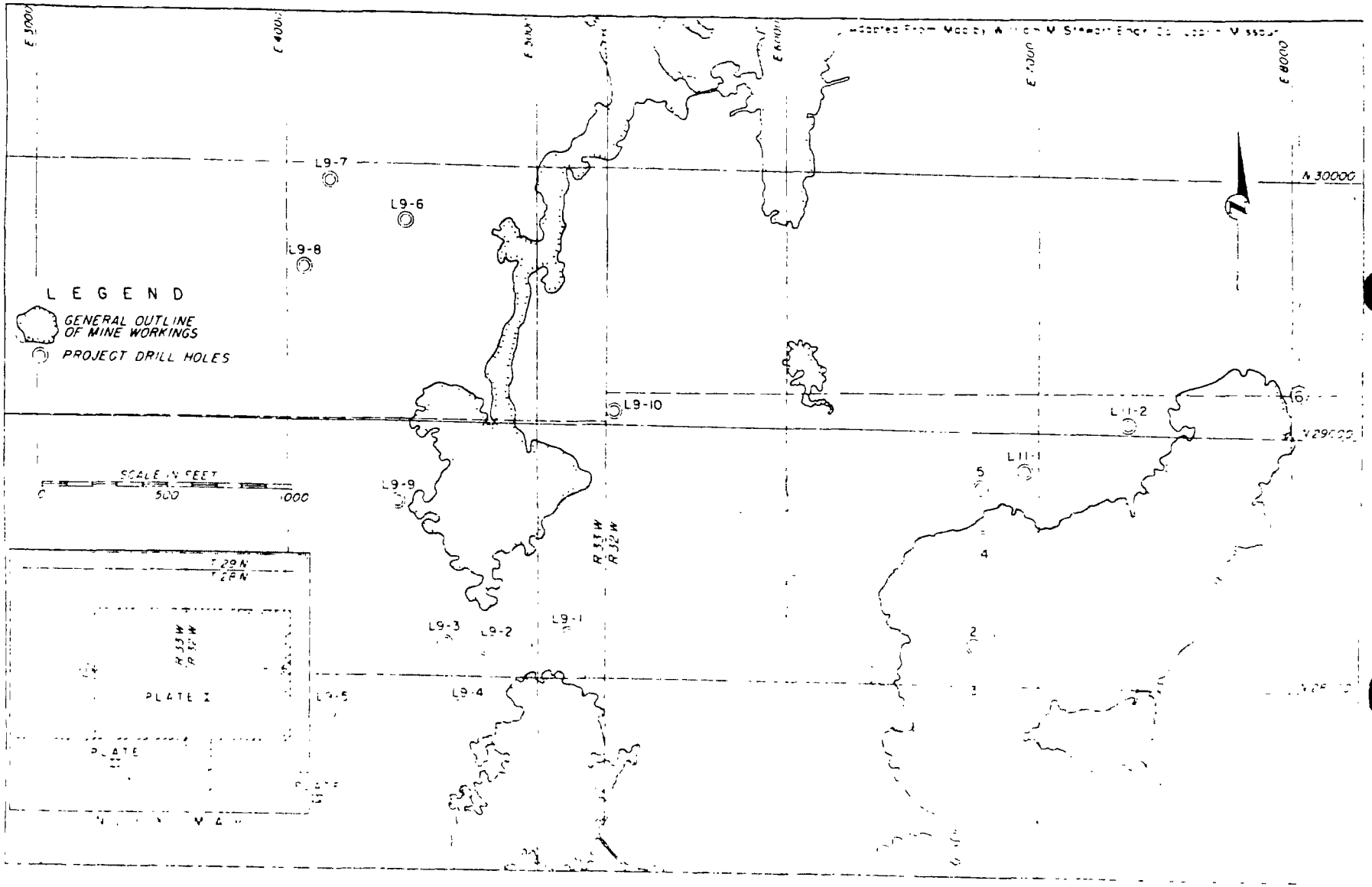

Figure 3. - Locations of project drill holes (plate I).

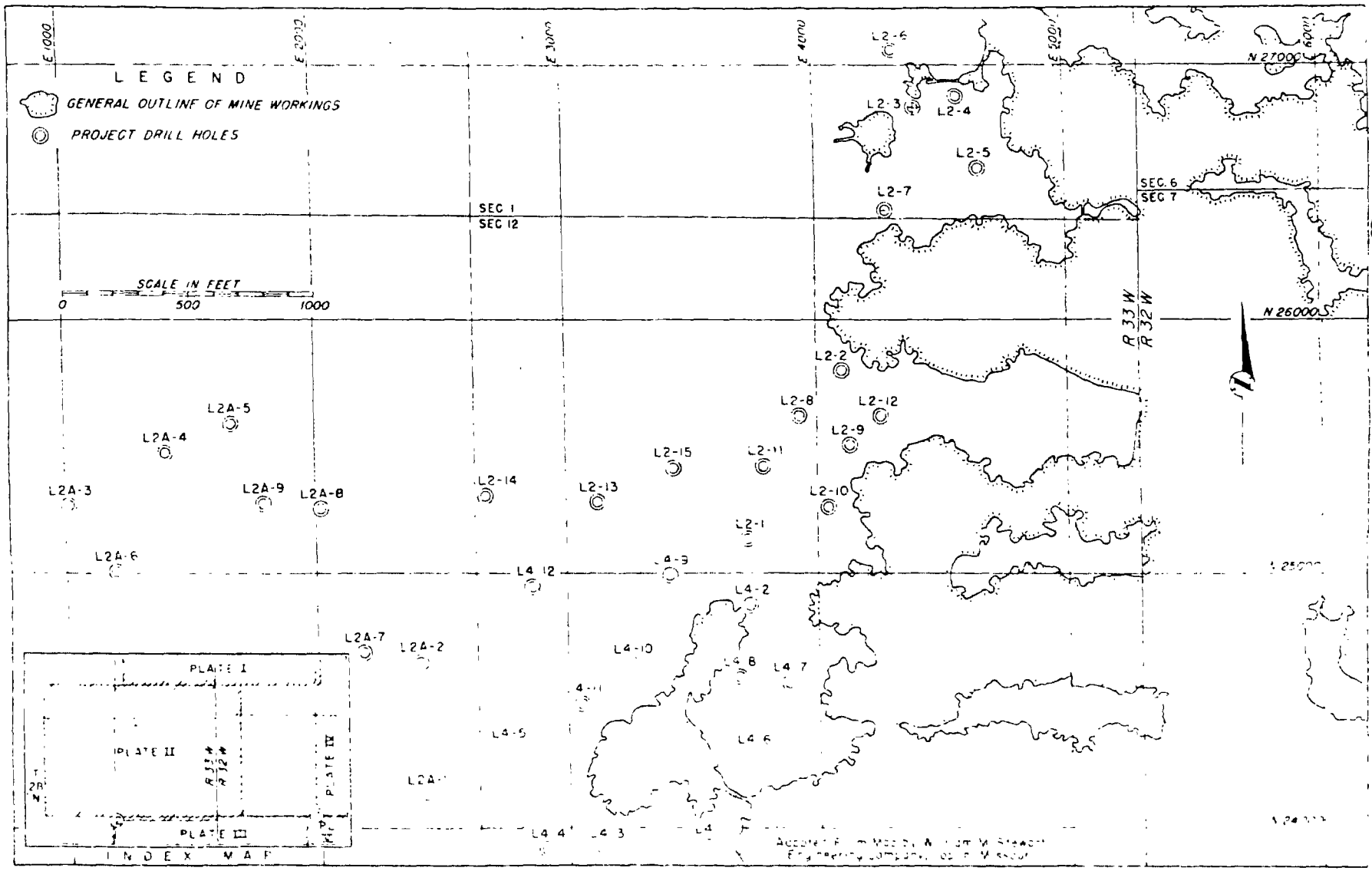

Figure 4. - Locations of project drill holes (plate II).

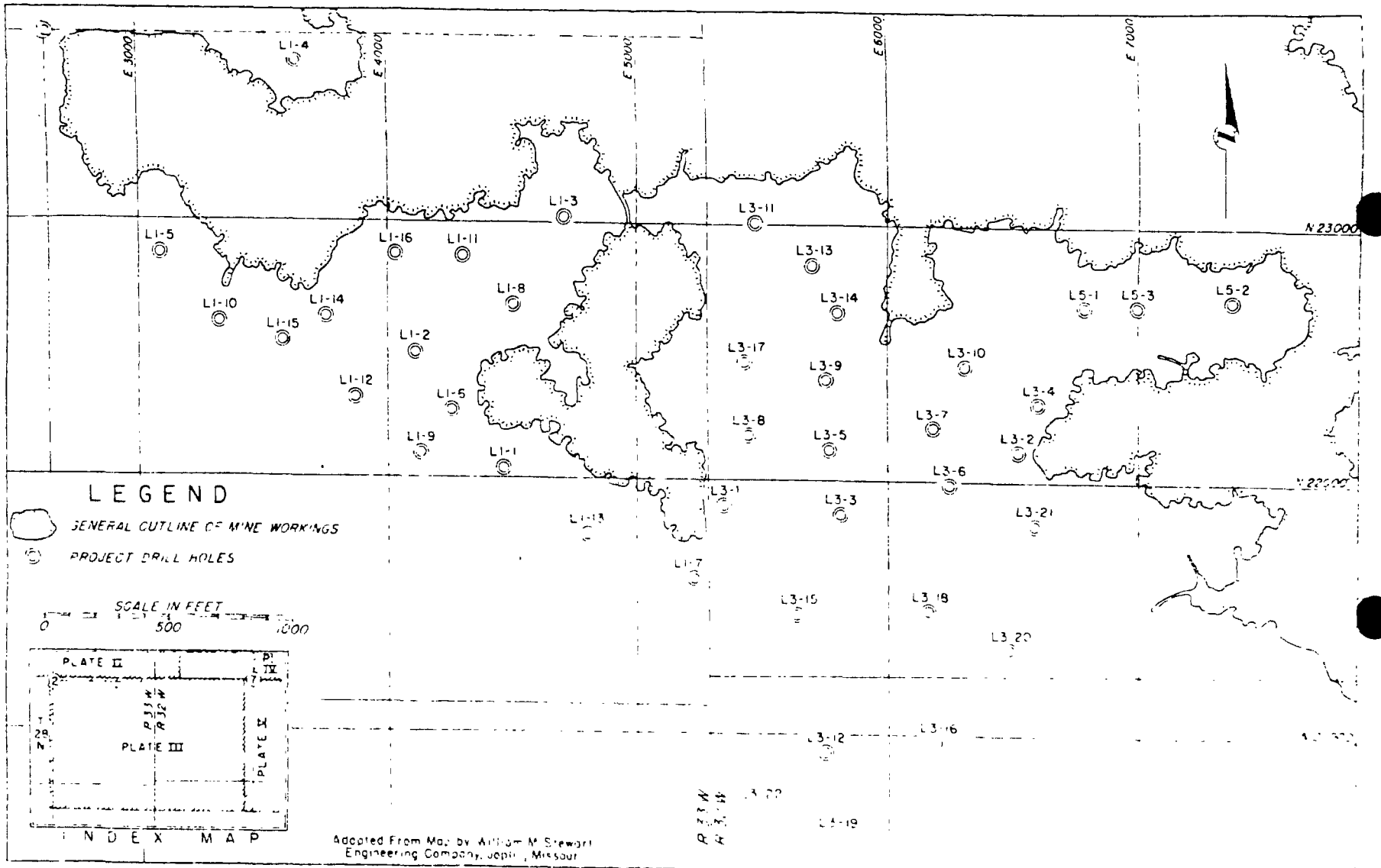

Figure 5. - Locations of project drill holes (plate III).

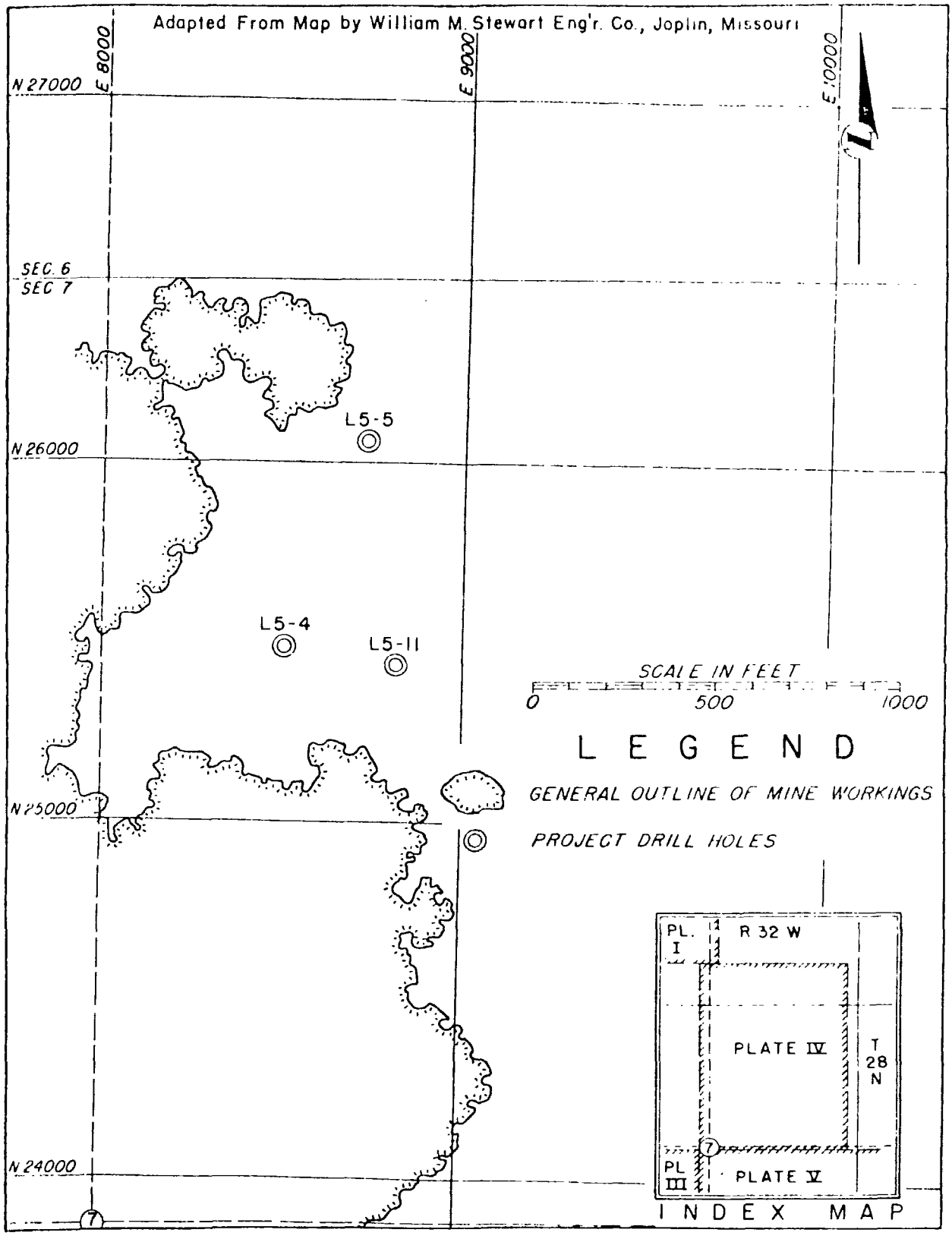

Figure 6. - Locations of project drill holes (plate IV).

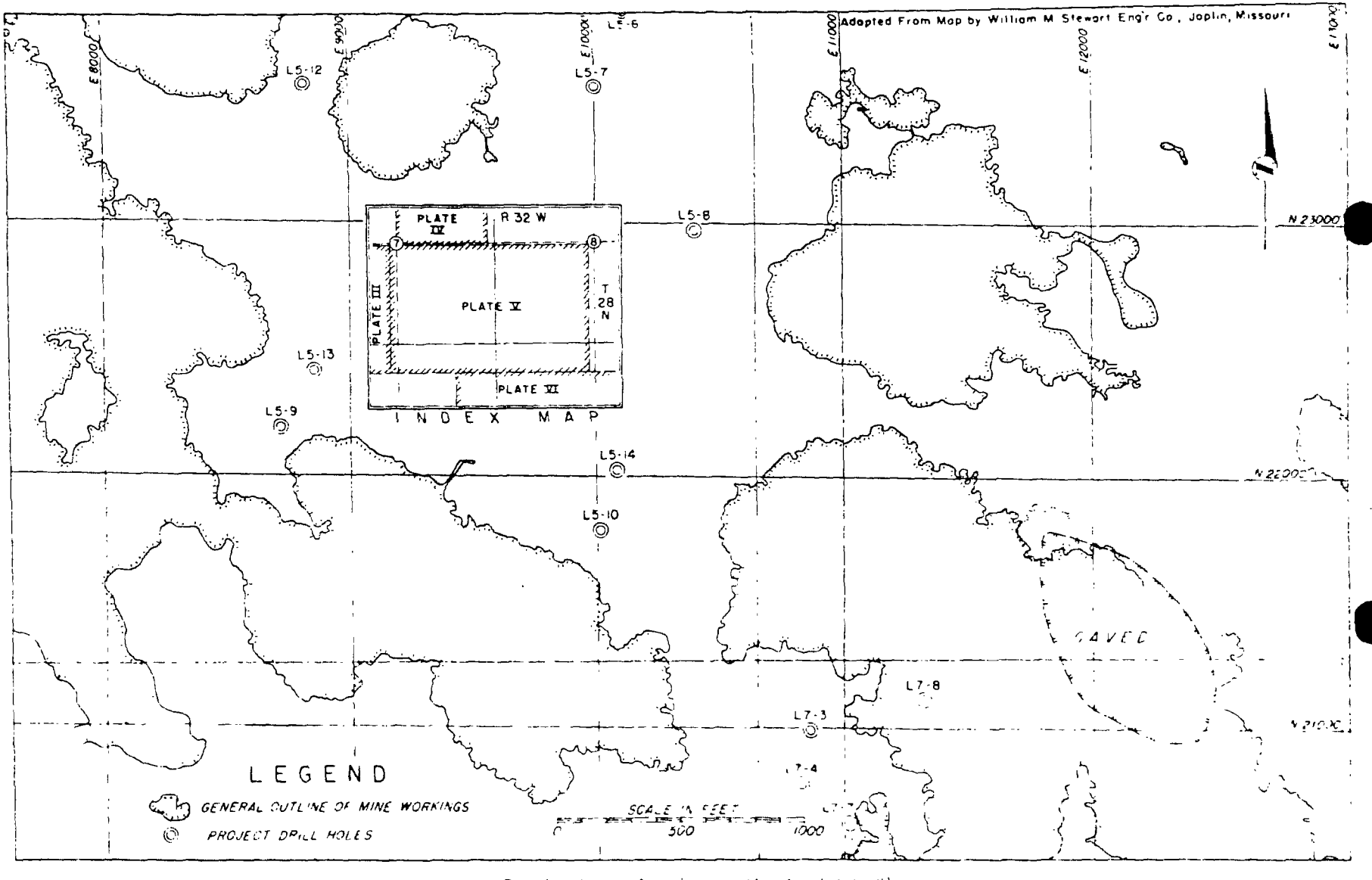

Figure 7. - Locations of project drill holes (plate V).

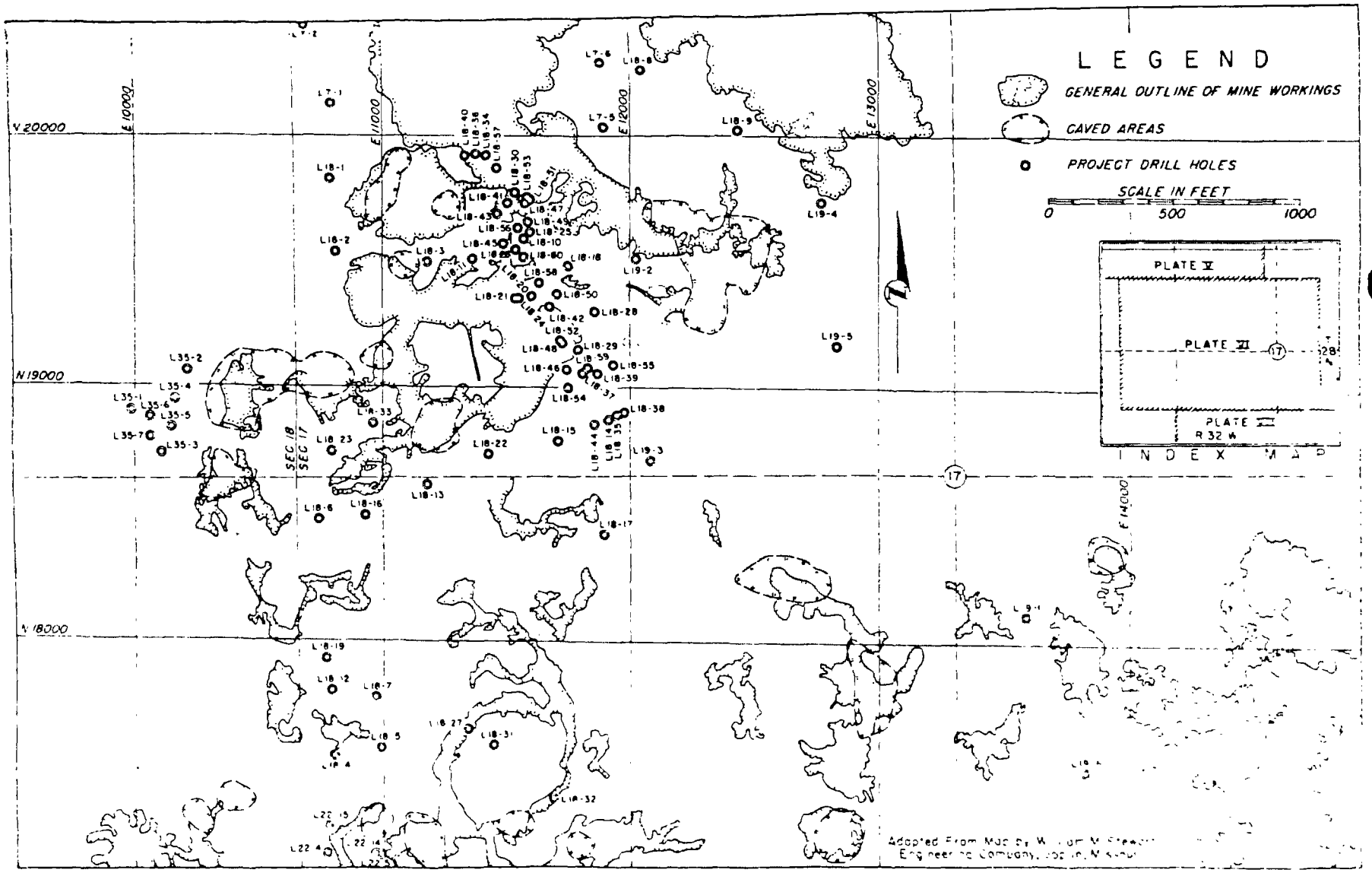

Figure 6. - Locations of project drill holes (plate VI).

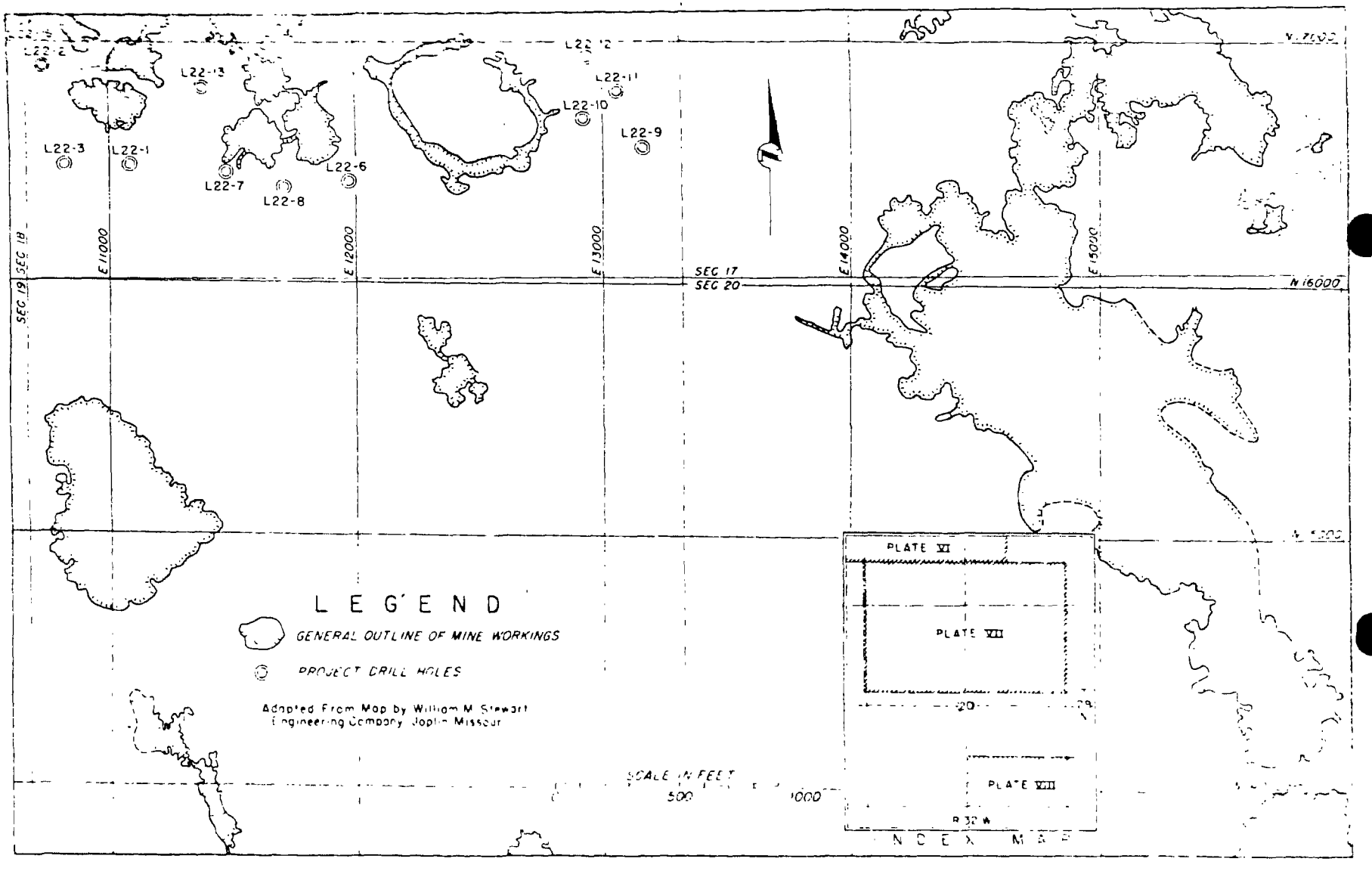

Figure 9. - Locations of project drill holes (plate VII).

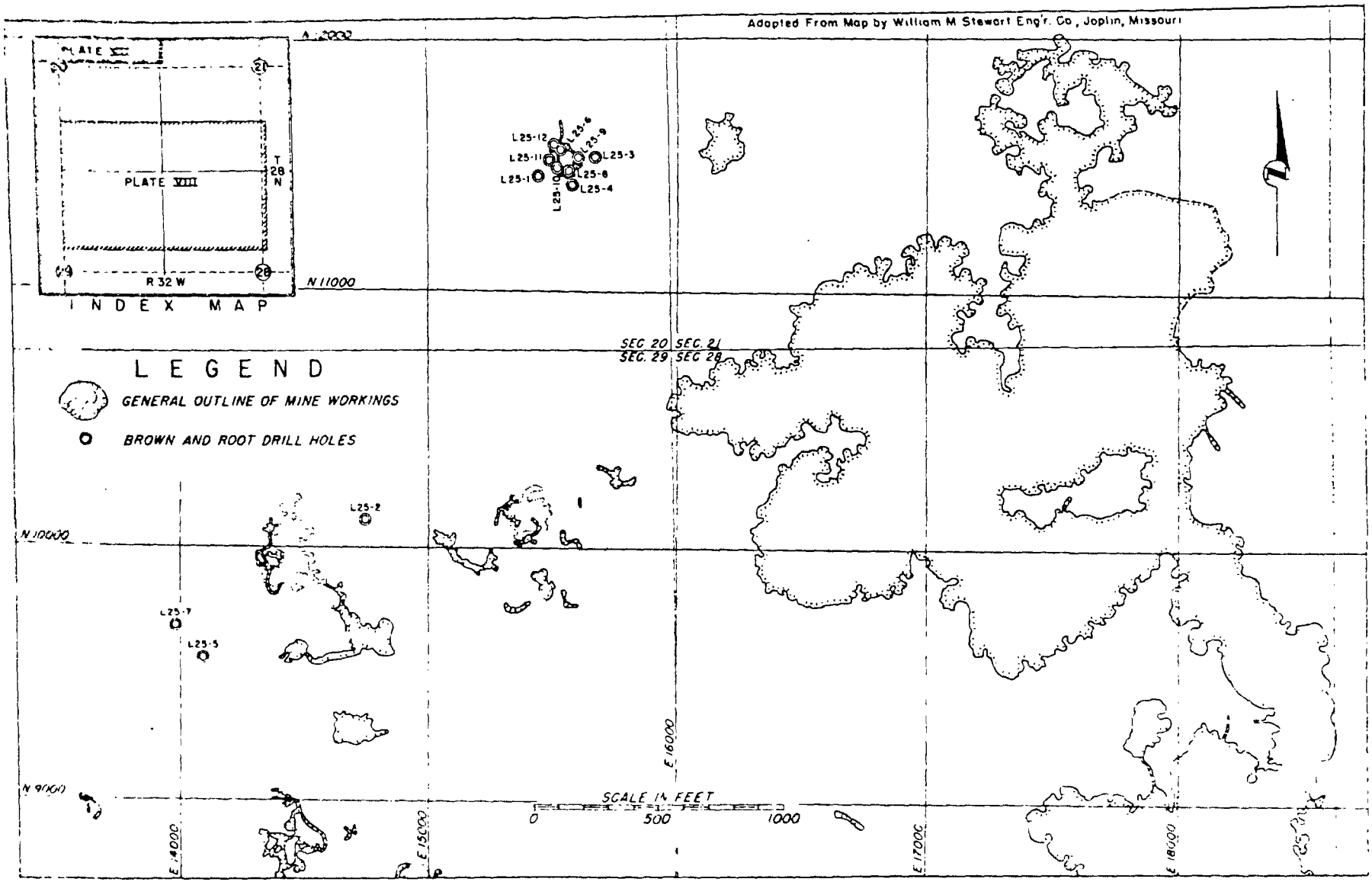

Figure 10. - Locations of Brown & Root drill holes (plate VIII).

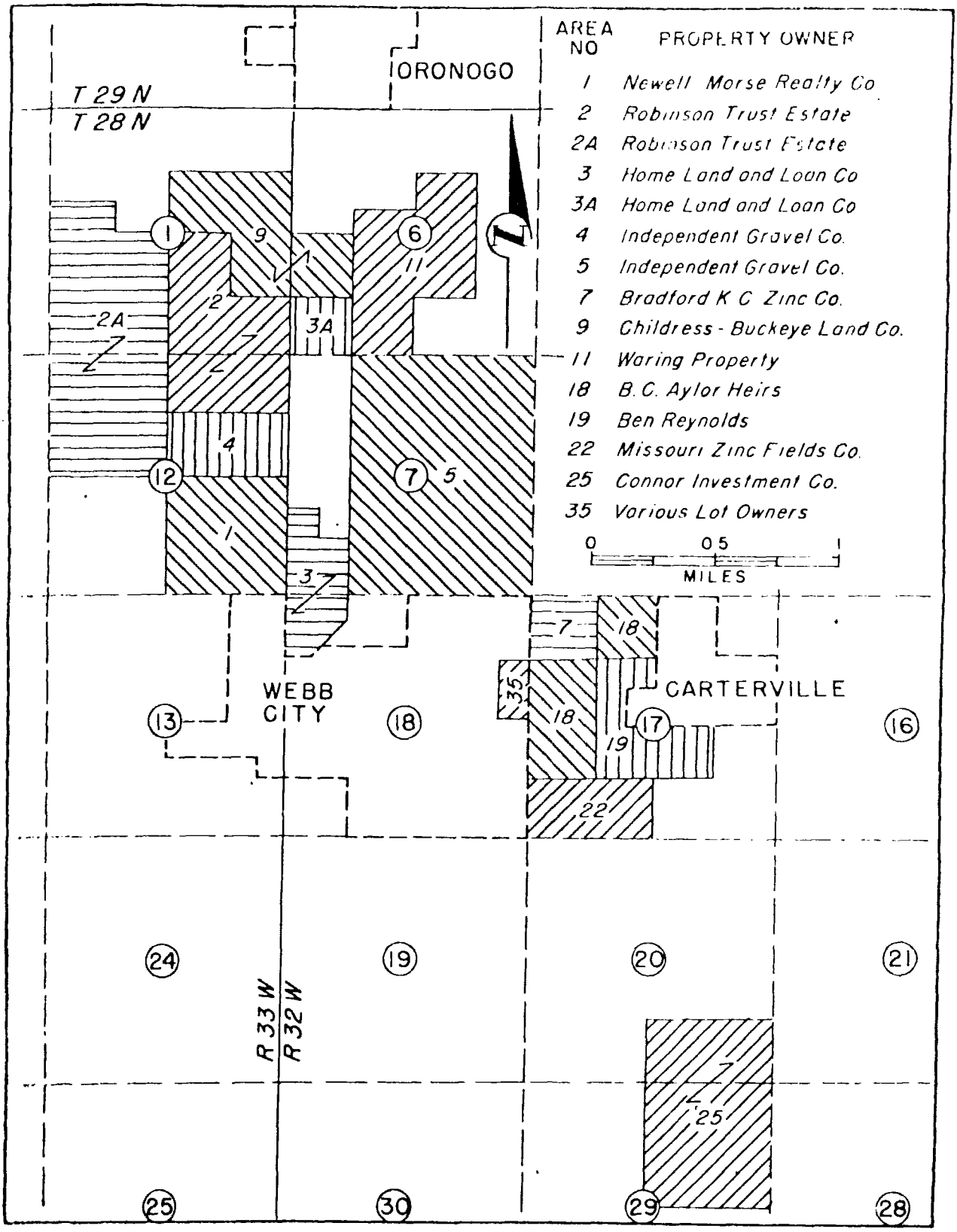

Figure 11. - Property ownership.

All the mines were opened by vertical or inclined shafts. Depending on the surface topography, the depth of the mine levels ranges from 150 to 240 feet. The sheet-ground ore bodies are flat-lying beds 6 to 30 feet thick, averaging close to 14 feet over the entire area. Roofs were supported by pillars, usually approximately 10 percent of the area mined.

WORK OF THE BUREAU OF MINES

In October 1942, the author was assigned to collaborate with the William M. Stewart Engineering Co. in an investigation of the possibilities of re-opening the "sheet ground" deposits in the central part of the district as a source of zinc to help meet the great wartime demand for that metal. The initial part of the work consisted in the determination of existing ore reserves, their grades, and locations. To that end, all available mine maps, old mine reports, and logs of old drill holes were collected, charted, and analyzed. Records were made of approximately one thousand drill holes, the locations of which were platted on a coordinated map. The outlines of all stoped areas also were delineated on the map.

Contracts for drilling on the project were made by Brown & Root, Inc., acting as agents for Metals Reserve Corporation. Excepting that done on leases 19, 25, and 35, all drilling was supervised by the author, and all drill holes were located by him in collaboration with Carl H. Plumb, engineer for Brown & Root, Inc. Sampling was done by samplers engaged by Brown & Root, Inc., under the supervision of an experienced sampling foreman of the Bureau of Mines.

Churn drilling on the project started on June 7, 1943, and terminated on January 12, 1944. Two hundred and ten holes were completed for a total of 45,047 feet of drilling. Previous to the inauguration of the project, the Oronogo Mutual Mining Co. drilled five holes for Brown & Root, Inc.

Descriptive logs of the 210 project holes and five Brown & Root holes follow.

Brown and Root, Inc., - Metals Reserve Co.
Jasper County, Mo.

Hole L1-1

Started: 6/7/43
Completed: 6/19/43
Elevation: 962 f.a.s.

SE¼ SE¼, Sec. 12, T. 28 N., R. 33 W.
Struck water: 90 feet
Water stands: 85 feet
Coordinates: 22035N-4460E

Depth, ft. From-	To-	Formation	Section From-	To-	Analysis, percent Zn	Pb
0	30	Clay and gravel	185	190	0.18	0.03
30	35	Clay and gravel, gray flint, black selvage	190	193	0.44	0.05
			193	195	0.54	0.06
35	65	Gray and dark gray flint, iron, black selvage	195	197½	0.28	0.08
			197½	200	0.24	0.10
65	90	Gray and blue flint, iron, black selvage	200	202½	0.20	0.06
			202½	205	0.22	0.06
90	105	Blue gray and yellow flint, yellow mud	205	207½	0.18	0.05
			207½	210	0.16	0.05
105	165	Gray lime, yellow and gray flint, yellow mud	210	212½	0.60	0.04
			212½	215	4.28	0.21
165	170	Gray and yellow flint, gray lime	215	217½	0.18	0.01
			217½	219	0.36	0.07
170	190	Gray flint, gray lime				
190	193	Sheet ground, jack shines				
193	212½	Sheet ground, trace of jack and lead				
212½	215	Sheet ground jack shines				
215	217½	Blue and gray flint, trace of jack				
217½	219	Blue and gray flint, brown lime				

Hole L1-2

Started: 6/7/43
Completed: 6/17/43
Elevation: 969 f.a.s.

NE¼ SE¼, Sec. 12, T. 28 N., R. 33 W.
Struck water: 30 and 197½ feet
Water stands: 80 feet
Coordinates: 22485N-4105E

Depth, ft. From-	To-	Formation	Section From-	To-	Analysis, percent Zn	Pb
0	5	Soil	192½	195	0.34	0.04
5	15	Blue and gray flint	195	197½	0.28	0.18
15	30	Red mud and boulders	197½	200	0.60	0.07
30	45	Blue and gray flint and	200	202½	6.98	5.86
45	65	Gray lime and little blue and gray flint	202½	205	1.80	1.13
			205	207½	0.60	0.09
65	80	Gray flint and little gray lime	207½	210	0.50	0.04
			210	212½	0.20	0.06
80	85	Gray lime and gray flint	212½	215	0.98	0.20
85	120	Gray flint and gray lime	215	217½	0.70	0.12
120	140	Gray lime and little gray flint	217½	220	0.60	0.07
			Repeated analysis:			
			207½	210	0.48	0.08

Hole L1-2 (cont.)

Depth, ft. From-	To-	Formation
140	155	Gray flint and little gray lime
155	160	Gray lime and dark gray flint
160	175	Light gray lime and little shale
175	180	Gray flint and gray lime
180	195	Gray flint and faint jack traces and little mundic
195	202½	Blue and dark gray flint and jack shines
202½	207½	Blue flint and lead and jack shines
207½	217½	Blue flint and jack traces and mundic
217½	222½	Blue and gray flint and faint jack traces
222½	225	Blue and gray flint and little gray lime
225	228	Gray and blue flint

Hole L1-3

Started: 6/10/43
Completed: 6/23/43
Elevation: 973 f.a.s.

NE¼ SE¼ Sec. 12, T. 28 N., R. 33 W.
Struck water: 197½ feet
Water stands: 90 feet
Coordinates: 23025N-4715E

Depth, ft. From-	To-	Formation	Section From-	To-	Analysis, percent Zn	Pb
0	8	Chat - surface water at 8 feet	180	185½	0.10	0.07
			185½	190	0.20	0.01
8	20	Yellow clay	190	195	0.18	0.04
20	32	Soapstone	195	197½	0.08	0.03
32	37	Gray and blue flint boulders - soapstone	197½	200	0.20	0.05
			200	202½	0.20	0.07
37	50	Gray lime, blue and gray flint	202½	204	1.46	0.06
			204	206	0.36	0.02
50	140	Gray lime and gray flint, more lime than flint	206	207½	0.38	0.05
			207½	209	0.20	0.05
140	149	White flint and soapstone	209	212½	0.48	0.30
149	155	Gray lime and gray flint	212½	215	0.18	0.05
155	168	Gray lime, white and gray flint, soapstone	215	217½	0.16	0.15
			217½	220	1.04	0.11
168	175	Dark gray lime and little gray flint	220	222½	0.36	0.04
			222½	225	0.38	0.02
175	197½	White flint and gray lime, strong water, sheet ground	225	227	0.32	0.03
197½	203	Gray water flint				
203	204	Gray and light blue flint, good jack shines				
204	212½	Gray and light blue flint, light jack shines				
212½	217½	Gray water flint, light trace jack				
217½	220	Dark gray and light blue flint, fair jack shines				
220	228	Light blue and gray flint, light traces of jack				
228	229	Light blue and gray flint, dark gray lime				

Hole L1-4